

REMARKS

Applicants claim foreign priority under the provisions of 35 USC 119, based on a claim in parent application S/N 09/452,259. Papers have previously been filed in parent application 09/452,259.

The rejection of claims 13 - 16 under 35 USC 103 is respectfully traversed as being moot in view of the current amendments.

Applicants readily agree that the Crane reference shows contacts 18 for the solder balls that are quadrilateral.

Applicants respectfully maintain, however, that the claims as amended distinguish over the reference. The reference has no mention of X-ray inspection which, as the claims now emphasize, is a functional requirement on the structure - i.e. the structure is one that is adapted for X-ray inspection.

Claim 13, as amended, requires that there be a difference in the X-ray image of a good joint and a bad joint - that is the purpose of the invention.

In the Crane reference, the contacts are shown as being much thicker than the solder balls - e.g. Fig. 8, showing solder balls that are minute compared to the total thickness of the contacts 18. Similarly, Figs 9, 11, 12, 13, 14, 15 and 16 show massive contacts that would produce the same image whether the solder wetted the surface or not. Fig. 28 shows a PCB to which the module of Crane is attached - i.e. Crane does not teach the attachment of solder balls to Fig. 28, but the carrier of Fig. 3 (for example) is attached to the PCB of Fig. 28. Since Fig. 28 is a top view, it teaches nothing about the thickness of the pads.

It is common knowledge that the density of an X-ray image results from a combination of the density of the material traversed and its thickness. Thus, since most metals have comparable density, the much greater thickness of the contacts 18 would overwhelm the effect of the thin film of solder resulting from a good joint.

Further, with respect to present claims 17 and 19, the contact surface to be wetted by the solder in Crane's Figs 12, 13, 14, 15, 16, 17, 18 and 19 show a surface that has a spherical portion that is cut off to contain the solder transversely. This means that an X-ray image of a good joint would look the same as that of a bad joint, because

the solder could not spread out to show a difference in the X-ray image.

Support for the limitation in claim 13 that the transverse dimension of the contact be greater than the solder ball is found in Fig. 6 and associated discussion, e.g. on the top of page 7.

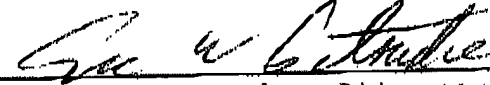
Support for the restriction on the difference in the images is found in Fig. 8 and associated discussion on page 7, lines 12 - 18; and the discussion of Fig. 7, page 7, lines 8 - 11, discussing the image of a good joint having a square shape.

The discussion of support in the preceding paragraph also applies to claim 14.

Thus, the amended claims require a structure on a substrate that is adapted for: a) attaching an array of solder balls and b) inspecting the quality of the joints by X-rays, the inspection being enhanced by a structure that shows in the X-ray image a difference between a good joint and a bad joint.

For the foregoing reasons, allowance of the claims is respectfully solicited.

Respectfully submitted,
John J. Garrity, et al.


by: Eric W. Petraske, Attorney
Registration No. 28,459
Tel. (203) 798-1857

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Appendix

VERSION WITH MARKINGS TO SHOW CHANGES MADE

13. (Amended) A substrate for the attachment of a ballgrid array electronic package thereto by means of solder balls and solder paste wherein connection is made between a contact on the ball grid array electronic package and a solder ball by means of a first joining medium and between said solder ball and a substrate contact arranged on the substrate by means of a second joining medium and wherein the contact arranged on the substrate is substantially quadrilateral in shape and has at least one transverse dimension greater than a diameter of said solder ball;

in which said substrate contact is adapted for X-ray inspection by directing X-Rays through said electronic package to illuminate said solder ball and said contact, so that a bad joint shows in said X-rays as a round image of said solder ball and a good joint, in which said solder ball flows into said substantially quadrilateral shape, shows in said X-rays as a quadrilateral image.

14. (Amended) A substrate as claimed in claim 13, wherein the contact arranged on the substrate is substantially square in shape; so that a good joint shows in said X-rays as a square shape.